Fine-Bodied White Earthenwares of Southeast Asia: Some X-Ray Fluorescence Tests

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HISTORIANS AND ARCHAEOLOGISTS studying Southeast Asia have frequently extolled the importance of trade as a factor in the development of the region's cultures. Southeast Asia first entered the consciousness of the Mediterranean world of the first century A.D. through the medium of the spice trade. Although few, if any, Greco-Roman traders seem to have visited Southeast Asia, they observed the produce of Southeast Asia as it arrived in the ports of south India, where during the golden age of the Roman Empire lay the principal junction of maritime trade between the Indian Ocean and the South China Sea.

The Greco-Roman outposts in India were abandoned in the third century A.D., during the early decline of the Roman Empire. At the same time the Chinese began to devote more attention to the maritime activities conducted by "barbarian" groups along China's south coast. By the early fifth century the Chinese were traveling to India by sea, in ships built, manned, and owned by sea-going people of Southeast Asia. By the seventh century, the center of gravity of Asian maritime trade had shifted to Southeast Asia, where it remained for over 1000 years, well past the date when Europeans rejoined the action.

Only a few Europeans, such as Marco Polo, visited Southeast Asia before the Portuguese conquered Malacca in 1511. Arabs and Chinese met in Southeast Asia at gatherings vaguely resembling medieval European trade fairs, and Southeast Asians sent missions with diplomatic and commercial duties to China. These activities have given us most of our documentary sources with which to analyze the cultural development of this region between the fifth and sixteenth centuries, when the wealth of its ports was proverbial, and its craftsmen were building such artistic monuments as the Borobudur.

Evidence for early Southeast Asian trade is almost entirely provided by foreign texts (Chinese and Arabic) or by archaeological discoveries of foreign imports (principally Chinese ceramics and Middle Eastern glassware). European accounts of Southeast Asia during the early colonial period (sixteenth to eighteenth centuries)

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also refer to intra-regional commerce in perishable goods, locally produced pottery, and metal, but the foreigners commented on intra-regional trade only in passing; their view was restricted both by their principal concern with international trade in luxury commodities and by the customs of Southeast Asian port societies, which confined foreign merchants to special residential quarters. Historical sources therefore are insufficient to develop a detailed picture of indigenous Southeast Asian maritime trade.

According to one model, early Southeast Asian trading kingdoms were little more than collecting points established to supply overseas demand, principally from China (Bronson 1977). Should we accept this model, then local trade would be of little consequence to our study of the growth of Southeast Asian civilization, and its omission from our data would be accounted no great loss. This image of the factors responsible for the particular course of development followed by Southeast Asian societies that actively participated in long-distance maritime trade may however be distorted by an overemphasis on the importance of that occupation with regard to local trade.

One of the authors of this article has tried to show that within one region, South Sumatra—the site of the famous trading kingdom Srivijaya between at least A.D. 682 and 1080 probably the most significant determinants of the forms and locations of centers of activities at various levels of the settlement hierarchy between the sixteenth and nineteenth centuries were internal commerce and communication patterns, not external factors such as foreign trade (Miksic 1984, 1985*a*). We lack sufficient information to prove that this proposition holds for the pre–European period.

One source of difficulty in studying early Southeast Asian sea trade is that most of the commodities traded, such as food, cloth, and wood, were perishable. Although earthenware pottery is found in abundance in many sites dating from the early historic period in Southeast Asia, archaeologists have had little success in using it to illuminate patterns of communication and trade between different sub-regions. This difficulty seems to stem from the circumstances that (1) Southeast Asian traditional pottery is relatively simple, and its forms and techniques displayed little variation throughout extensive areas for long periods of time, and (2) there is great diversity in the clay used in making pottery found at different sites, suggesting that pottery production was carried on at many locations, with distribution relatively restricted.

Archaeological data from the early historic period in Southeast Asia have been increasing at a slow pace compared to data for the prehistoric period. Enough information has now accumulated, however, to suggest that one type of earthenware was distributed over sites ranging from the Philippines to east Java, and from north Sumatra to Viet Nam. This type of ware also covers a broad chronological range, from the "Funanese" sites of the Transbassac, which date from no later than the late sixth or early seventh century, up to the Javanese sites dating from the end of the fourteenth century. This ware usually appears as a small minority among the local ceramic assemblage, from which it is easily distinguishable by its color, texture, and form. (For sites, see Fig. 1.)

One of the authors (Miksic) first became interested in this pottery while studying earthenware excavated at Kota Cina, a twelfth- to fourteenth-century trading port in northeast Sumatra. Out of 737 kg of pottery excavated in the early 1970s, 35 percent was stonewares and porcelain of Chinese provenance, and 65 percent (477 kg) was earthenware. The bulk of the earthenware fell into two types: sand-tempered and

Fig. 1. Sites where fine paste wares have been discovered in Southeast Asia.

shell-tempered. These were mostly utilitarian household vessels with thick bodies, handmade, with uneven surface coloration frequently bearing red slip or carved wooden paddle impressions, with gray to black paste. The pottery had not been fired long enough at a hot enough temperature to oxidize much of the organic material in the raw clay. These characteristics are identical to those of Southeast Asian pottery from the ethnographic period, which is fired in bonfires of rice straw and coconut palm fronds.

Among the 477 kg of earthenware, about 40 kg comprising about 5200 sherds was distinct from the coarse standard material. The paste of this ware is extremely fine, untempered, with fragments of volcanic glass, pyrite, and hematite occurring as natural inclusions, pale and uniform in color. The most common exterior color is between 10YR, 8/2 and 8/3, often with a gray core (2.5Y, 5/0). The vessels are wheel-made and very smooth to the touch. Bodies are thin, generally 3–4 mm thick. On an appreciable number of vessels the surface of the clay shows a tendency to flake off. The surface of the sherds, however, varies considerably; some are soft and "chalky," while others are smooth and hardened by burnishing.

Forms are quite elaborate, with many flanged necks and horizontal ribs, but there is little other decoration. Eighty sherds have incised linear decorations, and about 350 have red painted stripes. Shapes include covers or lids, nearly spherical bowls about 20 cm in diameter and 15 cm high, and a large proportion of spouted vessels, which in Southeast Asia are often called *kendi* (after Sanskrit *kundika* or *kamandalu*). Other forms are also present but cannot yet be reconstructed. (See Fig. 2.)

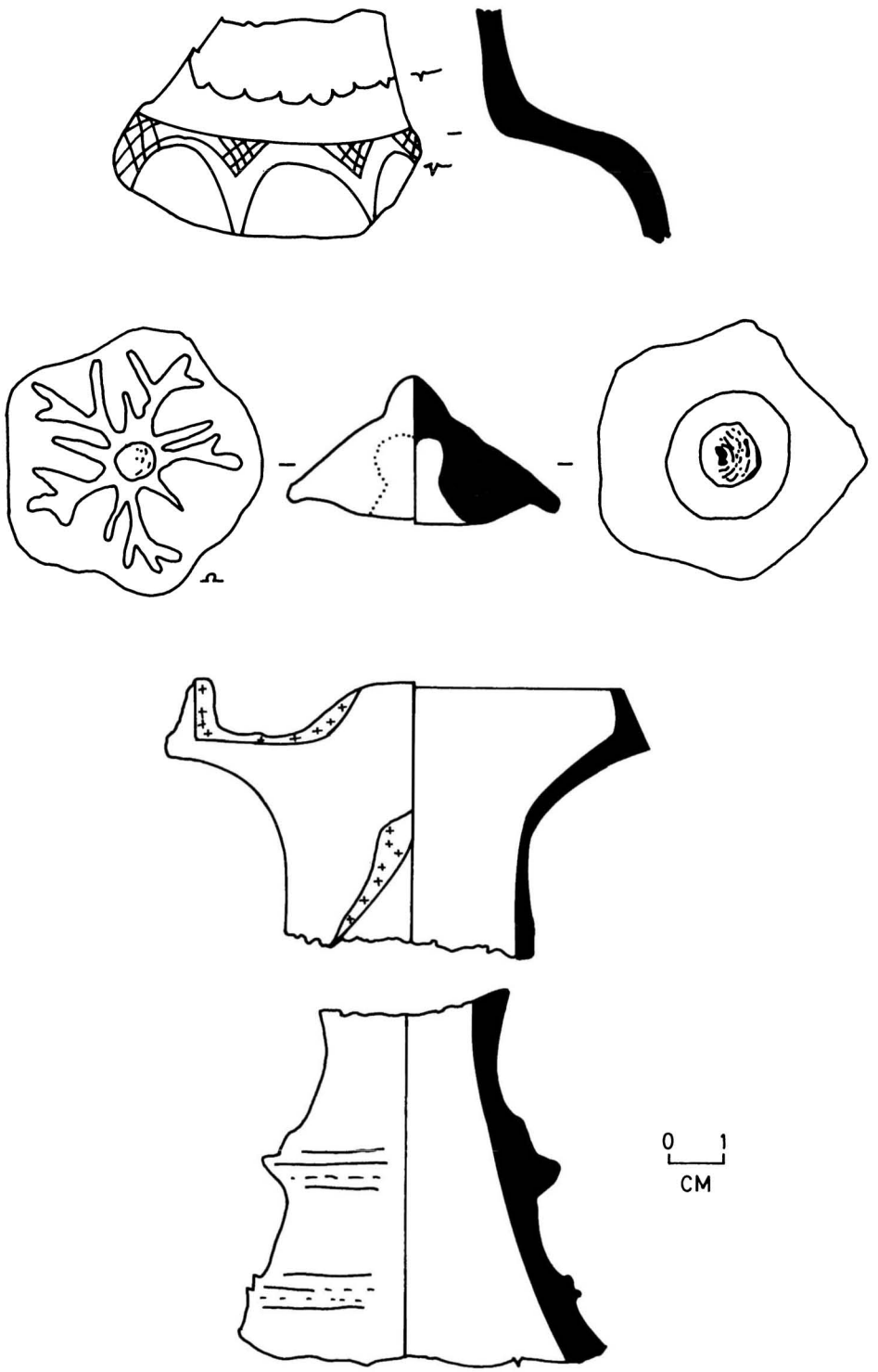

Fig. 2. Fine paste ware sherds from Kota Cina, Sumatra (12th to 14th centuries).

This type of earthenware, which was given the provisional name Fine Paste (FP) Ware, is so distinctive that it was necessary to consider the possibility that it had been imported to Kota Cina. Geological inquiry indicates that deposits of this clay—apparently a relatively pure kaolin derived from primary weathering of feldspar—are not found in north Sumatra. A search of the archaeological literature was then instituted to discover where the FP ware might have been made.

The French archaeologist L. Malleret described a ware found at the site of Oc-Eo, in the Mekong Delta area of Viet Nam, which he called Type V. It had the following characteristics, which well describe the material from Kota Cina and other sites to be discussed, with the exception of the ocher, which at other sites appears only seldom, as stripes:

> des pâtes fines, parfois assez dures, mais ordinairement tendres, de texture homogène, de coloration généralement rose au saumon, parfois jaunâtre, gris clair ou gris foncé, lisses et souvent onctueuses au toucher se delayant alors facilement dans l'eau et dont le dégraissant se laisse malaisément discerner à l'oeil nu. De place en place, des grains d'une coloration rouge foncé semblent indiquer l'emploi d'une terre peut-être antérieurement cuite et pulverisée pour être incorporée à la matière plastique. L'argile a été lavée et soigneusement triée. . . . Les décors sont ordinairement variés et les formes souvent élégantes. . . . Ces poteries ont été englobées à l'intérieur, comme à l'extérieur, d'un enduit ocre qui est souvent mat, mais parait parfois avoir été lustré. (Malleret 1960, II:99–100, pl. 10)

In addition to the protohistoric sites of the Transbassac, Malleret asserted that this same ware was found at Angkor Borei and Long-dien, where it was associated with other ceramics of mainly Angkorian date.

A. Lamb conducted excavations in the Bujang Valley, Kedah, Malaysia, in 1961, during which he unearthed "fragments of earthenware of a fine soft material of light yellow colour, though sometimes with a black streak in the centre" (Lamb 1961:26). According to Leong's recent review of the sherds, "the colours of the paste vary from an orange buff, buff to light brown" (Leong 1973:236, pl. XXIV, XXV).

Lamb later discovered "exactly this kind of ware at Satingphra [south Thailand], representing not only the same physical properties but also the same range of shapes and designs" (Lamb 1964:78, pl. 17). Lamb suggested that this coincidence could be the result either of trade or of common local tradition. At both sites the ware was found associated with Chinese ceramics and other artifacts of the twelfth to fourteenth centuries.

W. G. Solheim II reported on a graveyard in the Sarawak River delta, northwest Borneo (Tanjong Kubor), where Chinese sherds of the Tang dynasty were associated with various earthenwares, including 95 sherds from wheel-made vessels, with "fine homogeneous paste [which] is cream to peach in colour. . . . Some of the sherds have an extreme exfoliation" (Solheim 1965:52). Nine sherds were incised with concentric circles or curvilinear designs. There were 10 spouts and 1 complex rim form (Solheim 1965:53 fig. 18c). The spouts were attached to the bodies of the vessels by sticking them on a hole already made in the vessel. More fragments of such pottery were seen on the ground during a visit to the Bongkisam site in the Sarawak River delta in January 1988, in association with twelfth- to fourteenth-century Chinese porcelain.

Sherds of similar vessels have been found in the area of Trowulan, east Java, thought to have been the capital of the fourteenth-century kingdom of Majapahit,

which claimed vassals over an area larger than modern Indonesia. These objects are also found at numerous other Majapahit-period sites in east Java, such as the port of Tuban. Examples are illustrated in Adhyatman (1981: pl. 39, 1987: p. 26–42, color pl. 5). (See also Fig. 3 of this article.) Datable artifacts found at the Trowulan site derive mainly from the fourteenth and fifteenth centuries.

Sherds of the same material were found in association with ninth- and tenth-century Chinese wares at Butuan, Mindanao, Philippines. The excavators describe them as "problem sherds" of probably nonlocal origin. E. Edwards McKinnon, who cooperated with the North Sumatra Provincial Museum to excavate much of the Kota Cina material, has seen the Butuan sherds and confirms that they correspond visually to FP ware.

Surface surveys and inspection of sherds unearthed during temple restorations indicate that sherds visibly identical to FP ware are found at other sites, such as Muara Jambi, east Sumatra, which flourished from the late eleventh to fourteenth century; Banten Girang, northwest Java, another site that dates from the twelfth to fifteenth centuries; and Gatak, a site in the Prambanan plain, near the famous central Javanese temples of the eighth and ninth centuries.

The FP Ware from Kota Cina and that from the other sites listed here form a visually homogeneous group which stands out clearly from the utilitarian wares of presumed local manufacture. This raises the possibility that FP Ware may finally present us with an example of a locally produced commodity that circulated widely within Southeast Asia. Its distribution thus might delineate the shape of an early network of internal commerce. If we were to find that this network's form and the relative intensity of interaction between various points along it were significantly different from the pattern of exchange represented by the distribution of imported (Chinese) ceramics in Southeast Asia, this discovery would support the hypothesis that local commerce was not a by-product of unilateral ties between Southeast Asian ports and China. Rather, it would indicate that the opposite situation may have existed, wherein intra–Southeast Asian relationships were more significant determinants of site locations and activities (and, by inference, social institutions as well). In this case the current evaluation of the importance of long-distance maritime trade in the development of Southeast Asian cultures would have to be revised.

One vital step toward resolving this question is to identify the center or centers of production of FP Ware. Barbara Harrisson, curator emeritus of the Princesshof Museum, Leeuwarden, The Netherlands, has inspected the Kota Cina FP sherds and notes a similarity between the paste and that of Vietnamese parallels to *qing bai*/ Marco Polo Ware. Harrisson further discerns a correspondence with the Sa-huynh tradition of Southeast Asian pottery design, which developed in southern Viet Nam, and also a connection with "Hindu" symbolism and esthetics. Both Harrisson and Solheim believe that FP Ware originates "somewhere in the Hindu sphere of influence" (pers. comm.).

Large deposits of suitable clay are found in northeast Java, not far from Trowulan, in the Lamongan district, Gresik, where it is utilized by a large cement factory (Adhyatman 1981:49, 177n68, quoting Abu Ridho). The advanced technique of potting and uniformity of color suggest strongly that FP Ware was fired in a closed kiln. No remains of kiln structures have been found in Java, although some lead-glazed architectural elements found at Trowulan are thought to be of local manufacture, suggesting that the Javanese possessed some kind of kiln technology.

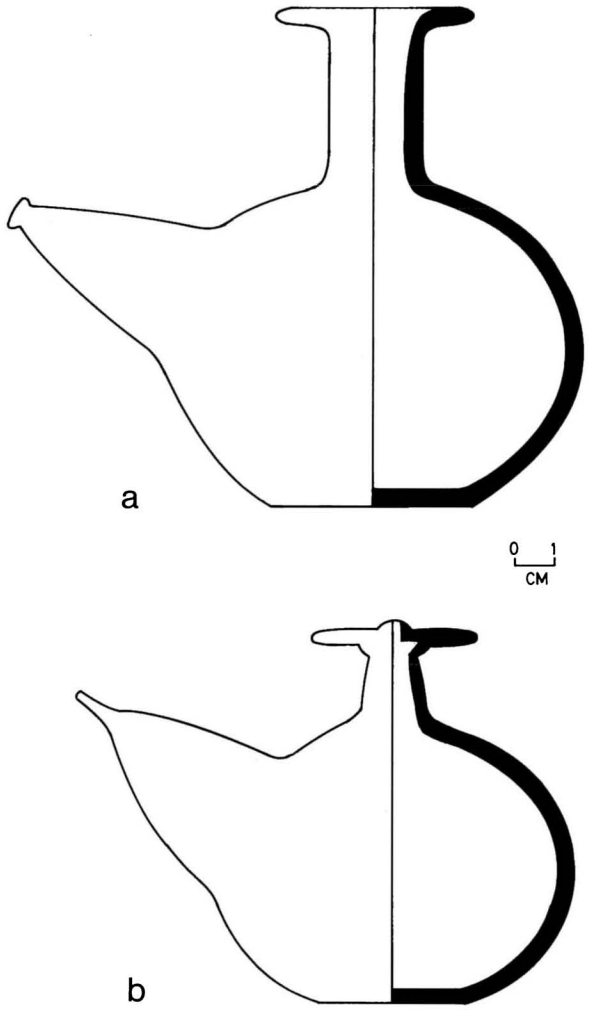

Fig. 3. *a,* Fine paste ware, said to have been found in East Java. *b,* Fine paste ware *kendi,* said to have been found in East Java.

A feature identified as a kiln mound has been identified at Kok Moh, Ban Pa O, south Thailand, not far from the Satingphra site (Stargardt 1973*a,* 1973*b,* 1983). The site was, however, highly disturbed, and no stratigraphic details of the archaeological research done there have yet been published. Moreover, suitable clay is not found at Kok Moh, although it is found at Ko Nang Kham, an island in Lake Songkhla (information from Tharapong Srisuchat, Fine Arts Department, Bangkok). Stargardt (1983) has concluded that the Kok Moh site production was largely confined to the twelfth century. Until a more detailed description is published on excavations undertaken at this site in 1972–1973, the nature and period of activities at the Kok Moh site will remain in doubt. If the twelfth century is a correct dating for both the inception and termination of manufacture of FP Ware at Kok Moh, then we must inquire where the earlier and later objects of similar clay and style were made.

It is premature to assume that all FP–type ware was manufactured in one area. We cannot ignore Lamb's suggestion that the practice of making fine white-bodied ceramics for ceremonial use may have been a widespread Southeast Asian tradition rather than a specialization of one particular site. Suitable clay is found in a number of places in Thailand and Indonesia.

X-RAY FLUORESCENCE TESTS

The optimum solution to the problem of tracing early Southeast Asian intra-regional trade is to conduct extensive laboratory tests to analyze the composition of artifacts with known proveniences suspected to have been trade items, and to isolate trace elements that can be correlated with specific sources of raw materials or production sites. Besides pottery, metal is a promising source of such objective data on exchange. Little research has been conducted on this topic in Southeast Asia, except for one study which strongly supports the conclusion that gold from the Sarawak River hinterland was taken to the Bujang Valley, Kedah, peninsular Malaysia, by the fourteenth century (Treloar 1968).

In an effort to shed some light on this question, a group of 40 sherds from 7 sites has been analyzed at the Department of Physics, National University of Singapore, using the X-ray fluorescence technique. This laboratory has already obtained encouraging results by applying this method to the study of Chinese porcelains (Yap 1984, 1986, 1987).

The X-ray fluorescence technique is nondestructive and uses fluorescent X rays as a method of elemental analysis. An atomic electron can be completely removed from its shell by a photon (X ray or gamma ray) whose energy is greater than the electron's binding energy, leaving the atom in an excited state. In the ensuing de-excitation, an electron from a higher shell "drops" into the vacant site, giving up an excess but well-defined quantity of energy by the emission of a fluorescent X ray. Measurement of the energies of these fluorescent X rays allows the observer to identify the elements present in the sample. We can also determine elemental concentrations by measuring their intensities in conjunction with appropriate calibration graphs.

Figure 4 shows the configuration of the X-ray spectrometer at the Department of Physics, consisting of a Si(Li) detector with the associated electronics and multichannel analyzer, which is coupled to a computer for data storage and analysis. All acquired spectra were analyzed by the commercial program AXIL (*A*nalysis of *X*-ray spectra by *I*terative *L*east-squares fitting). This program was developed by the University of Antwerp (Belgium) group for the deconvolution of complex multichannel X-ray spectra produced by a Si(Li) detector. For proper results the geometry of samples has to be fixed in a particular manner, explained in Yap and Saligan (1986).

Previous studies have made clear that not all elements are useful for identifying the origin of Chinese porcelains (Yap et al. 1987). For example, the scatter in the concentrations of lead (Pb) for samples from various regions shows that there is no correlation between lead concentration and place of manufacture. However, certain elements, such as rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb), are in general quite useful for this purpose. This is especially so if the

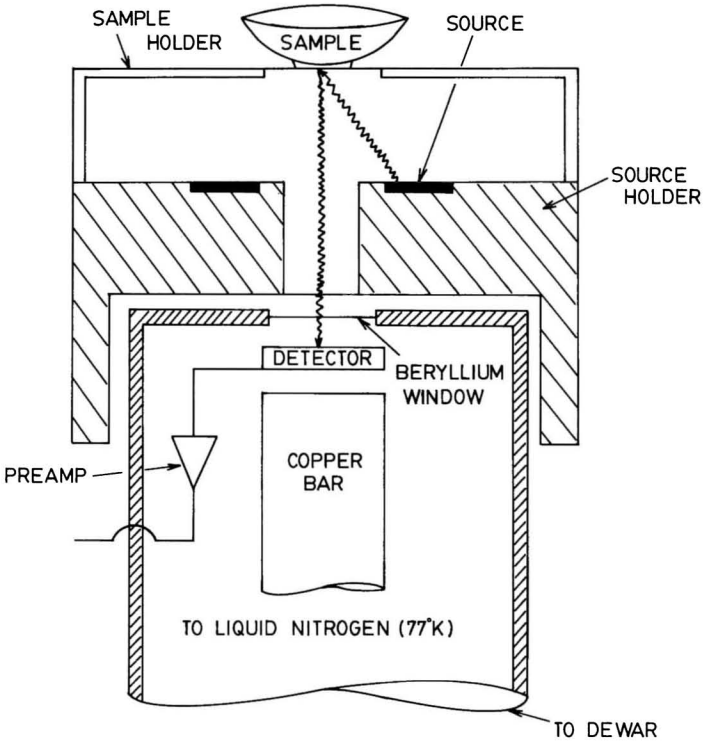

Fig. 4. Si(Li) detector assembly and radioisotope excitation system with annular source configuration for direct irradiation.

results are displayed on a triangular plot, such as the one shown in Figure 5 where the relative intensities due to Rb, Sr, and Zr are calculated such that

$$I_{Rb} + I_{Sr} + I_{Zr} = 100\%.$$

For such a plot, the corners of the triangle represent 100 percent of each of the relative intensities, but for Figure 3, only the left part of the triangle is shown. The clusters that appear show significant correlation between these three elements and the archaeological provenance of the samples, which suggests that we may draw meaningful inferences from the data despite the small number of samples from each individual site included in this study.

These sample sherds fell into three categories. Some were of FP–type material; others of coarser type assumed to be of standard local manufacture were included for comparative purposes; and a third set consisted of sherds of fine, untempered ware which is, however, visually quite distinct from the FP Ware. This third set is of a uniform dark red (2.5 YR, 5/4–6/6), probably wheel-made, almost always highly burnished. The shapes of the objects made of this material show some general similarities to the FP Ware: many are *kendis* with flanged mouths (Fig. 6; Adhyatman 1987: pl. 7). These sherds are found at sites in central and east Java that date from the ninth to fifteenth centuries.

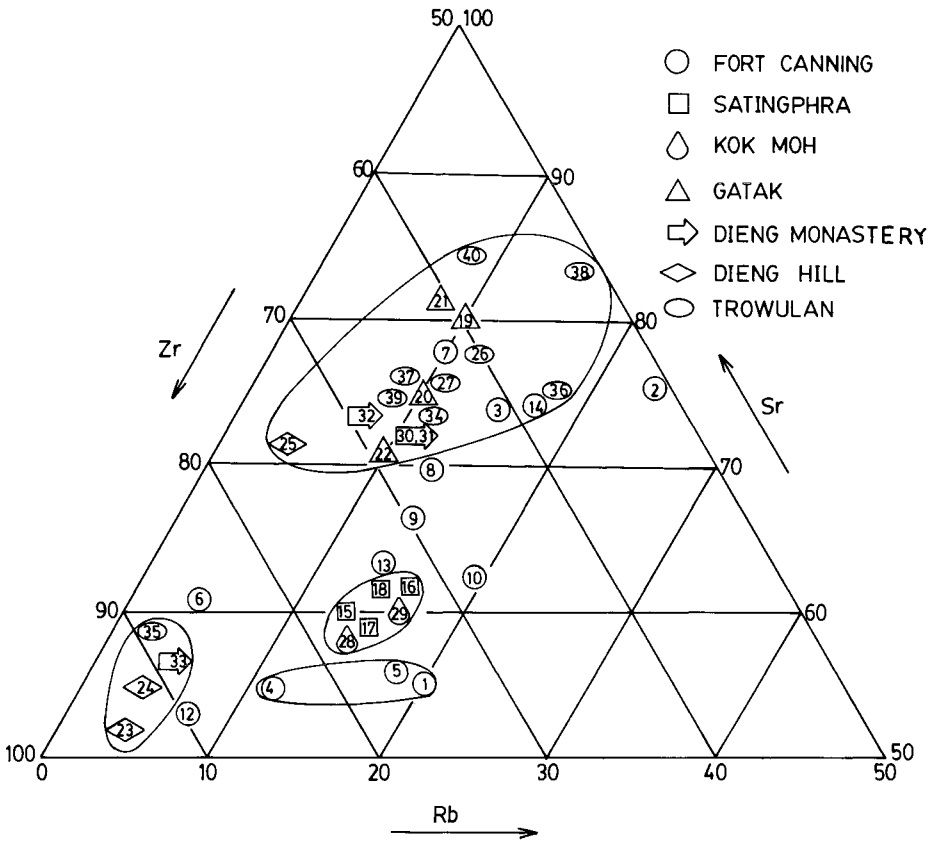

Fig. 5. Triangular plot using the intensities of Rb, Sr, and Zr as axes. Note: No. 11 lies outside the range of this diagram (at 93% Sr, 6% Zr, 1% Rb).

Detailed data on the individual sherds are found in the Appendix. Inspection of the data leads to the following conclusions.

1. Samples 1, 4, and 5 were excavated in Singapore in 1984 from a fourteenth-century context, at a site called Fort Canning. They represent a type conventionally called Guangdong (Kwantung) ware: light-colored stonewares believed to have been made in south China. The fact that they form a distinct cluster here suggests that they were indeed made at one place, although that location remains conjectural.

2. Sample 2 was also excavated at Fort Canning. It represents a second variety of stoneware found at many twelfth- to fourteenth-century sites in Southeast Asia, and is believed to have been made in eastern China, perhaps in Fujian Province, although this is again conjectural. Its position on the graph indicates that it falls into none of the other sherd groups.

3. Sample 6 lies outside any group. It is suspected to be a fragment of a mineral used as a coloring agent rather than a ceramic article; this inference is fortified by its mineral content. Sample 7 is derived from a type of earthenware termed *Type D* at Fort Canning, apparently used specifically as roofing material; further analysis indicates it possesses an extremely high barium content compared with other pieces. It stands apart from the other Singapore earthenwares. Sample 11 was also suspected of being a piece of lime mortar rather than a ceramic material; its anomalous position suggests that it is indeed mostly chalk.

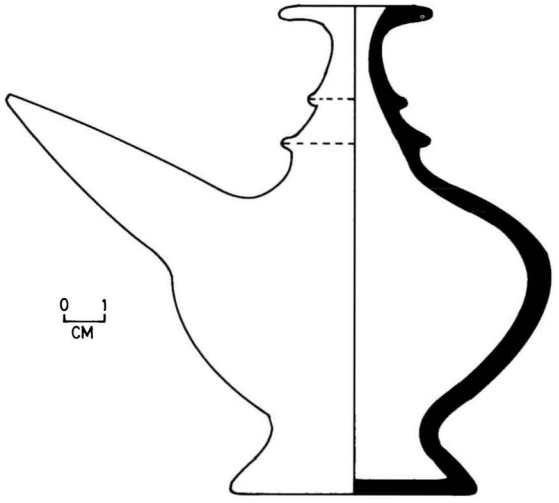

Fig. 6. Javanese red burnished ware.

4. Samples 3, 8, and 9 were part of a group of sherds excavated at Fort Canning and termed *Type C*. They form a loose cluster, separate from samples 10 and 13, which were placed in another category, Type A2. Type C was the most common earthenware from Fort Canning and is thought to have been made locally, whereas Type A2 resembles the FP Ware. Both samples 10 and 13 lie close to the cluster formed by the sherds from south Thailand, suggesting that they may have been made in the same place. Samples 12 and 14 are two different types of tile from Fort Canning, termed *A3* and *A4;* they lie so far apart on the graph that it might be better to give each sample a different type designation.

5. Samples 15–18, 28, and 29 come from surface collections made in south Thailand. Although it is not possible to give quantitative data, gross observation of surface finds in the area and collections in local museums suggest that this FP–like material, either without any temper or with only very fine added material, was the standard clay source used both for ceremonial and utilitarian objects. One sherd analyzed here came from a large, thick storage jar. It seems likely that such ware was manufactured in south Thailand, at Kok Moh or other nearby sites, and that some examples of it were taken to Singapore in the fourteenth century. This is not surprising given the close historical relationship between these two areas in the fourteenth and fifteenth centuries, when Siamese kingdoms (Ayudhya after 1351) claimed Singapore and other Malay kingdoms as vassals (summarized in Miksic 1985*b*).

6. The specimens from Gatak, central Java (samples 19–22) were excavated in 1985 in association with architectural remains, other earthenwares, and Chinese ceramics dating from the ninth century. Despite their strong superficial resemblance to FP Ware from south Thailand, their composition is quite distinct from that of the Kok Moh and Singapore samples. It is unlikely that they came from south Thailand.

7. Samples 23, 24, and 33, which form a compositional group, were found during surface survey on the Dieng Plateau, central Java; 23 and 24 came from a hill on the northwest side of the plateau near a ruined temple, and 33 came from a site on the west plateau provisionally designated a monastery complex, where most activity on the plateau was concentrated during the seventh and eighth centuries. They are coarse in texture and dark red in color. They are clearly distinguished from the other samples from the Dieng plateau (25, 30–32), which cluster among a second group of artifacts obtained from surface surveys on the site of Trowulan, east Java (26, 27, 34,

36–40). (Only sample 35 gives an anomalous composition among the Trowulan samples.) The artifacts from the Dieng plateau and Trowulan share certain physical and technical characteristics, chief among which are a lack of temper, a dark red color, thin bodies, and smooth surfaces produced by burnishing. They seem to derive mainly from small *kendis*.

PROVISIONAL CONCLUSIONS

The composition of the fine white-bodied earthenware found at Satingphra, south Thailand, appears on the basis of X-ray fluorescence testing to resemble closely that of a group of sherds from a contemporary site in Singapore. Similar material from north Malaysia and Sumatra may prove to have been exported from south Thailand, although no samples have yet been analyzed. On the other hand, visually similar sherds found in central Java seem to have come from east Java rather than Thailand. The X-ray fluorescence results suggest that two types of ceremonial ceramics were made in east Java during the ninth to fifteenth centuries, one producing red ware, the other white, the products of which were exported to central Java during the late first millennium A.D.

Thus there is evidence that earthenware of a relatively high aesthetic and technical standard was produced in at least two widely separated centers in early historic Southeast Asia, and some was exported to other parts of the region. Not until many more samples have been analyzed will it be possible to establish the pattern of commerce in this commodity, or to draw precise boundaries between the spheres of distribution from the various centers of its manufacture. However, these preliminary results indicate that research into the Fine Paste ceramic tradition (or sphere of interaction?) can untangle some knotty problems of early Southeast Asian cultural development and supply a useful aid to those interested in exploring the possibility of interpreting such development in autonomous terms. Further research is now in progress to analyze samples from Sumatran sites in an attempt to discover whether they fall into the south Thai or east Javanese groups on the basis of elemental composition.

ACKNOWLEDGMENTS

We wish to thank Mr. T. H. Ng for his assistance in data collection and Miss E. T. Foo for drawing the diagrams.

APPENDIX

Description and Provenience of Sample Sherds

Sample	*Site*[a]	*Color*	*Description*
1	FTC	7.5YR, 8/2	Guangdong-type stoneware with combed interior, wiped exterior; probably from south China.
2	FTC	(glaze) 2.5YR, 4/4 (body) 7.5YR, 8/0	Olive-glazed brittleware. Possibly from south China.

Sample	*Site*[a]	*Color*	*Description*
3	FTC	(exterior) 7.5YR, 7/4 (interior) 7.5YR, 8/4 (cross-section) 7.5YR, 4/0	Type C body sherd. Coarse material, probably made in or near Singapore.
4	FTC	10YR, 8/3	Guangdong jar, probably from south China.
5	FTC	10YR, 8/4	Guangdong jar with interior wiping; probably from south China.
6	FTC 4L	2.5YR, 6/8	Coloring agent? Mineral, nonceramic.
7	FTC 1L	2.5YR, 5/6	Knob of eavesboard tile. Type D. Many coarse white inclusions up to 2 mm diameter; probably made in Singapore.
8	FTC 1L	(surfaces) 7.5YR, 8/4 (cross-section) 7.5YR, 5/0	Type C (Singapore made?).
9	FTC 1L	(body) 7.5YR, 8/2 (slip) 5YR, 6/4	Type C rim, coarse quartzite temper, dark gray cross-section. Singapore made?
10	FTC 4L	(exterior) 7.5YR, 8/4 (interior) 7.5YR, 6/6	Type A1. Coarse quartzite temper. Slipped on interior.
11	FTC	white	Chalk tile mortar, nonceramic.
12	FTC 1L	2.5YR, 6/8	Type A3 (tile variant).
13	FTC L4/5	5YR, 7/8	Type A2 (Identical to FP ware).
14	FTC 1L	5YR, 7/6	A4 tile. Singapore made?
15	STP	7.5YR, 8/4	Rim of small everted vessel.
16	STP	(surfaces) 5YR, 8/4 (cross-section) 5YR, 5/1	Rim or lid? Close to Kota Cina material.
17	STP	10YR, 8/3	Sharply molded rim, fine parallel striations on exterior and interior.
18	STP	10YR, 8/3 (exterior) 10YR, 7/1 (interior)	Body sherd. Close to Kota Cina material.
19	GTK	10YR, 5/1	Body sherd.

Sample	*Site*[a]	*Color*	*Description*
20	GTK	10YR, 8/2	Body sherd.
21	GTK	7.5YR, 4/0 (exterior) 7.5YR, 8/2 (interior)	Body sherd.
22	GTK	10YR, 8/3 (Body) 10YR, 8/3 (stripe)	Identical to striped FP Ware.
23	DNG	7.5YR, 7/6 (exterior) 7.5YR, 8/4 (interior)	Relatively thick, not burnished, but finely wiped on interior. Made with slow wheel? Javanese ceremonial ware?
24	DNH	10YR, 8/3	Thick, unburnished, "local" utilitarian ware.
25	DNH	5YR, 6/6	A few quartzite inclusions, cloudy irregular color.
26	TRO	2.5YR, 6/6 (surfaces) 2.5Y, 8/2 (cross-section)	Fine burnished ware.
27	TRO	2.5YR, 6/6	Fine burnished ware.
28	KKM	7.5YR, 8/4 (surfaces) 7.5YR, 8/0 (cross-section)	Kok Moh white ware.
29	KKM	7.5YR, 8/4 (1 mm outer layer) 5YR, 6/6 (second lens) 7.5YR, 7/4 (interior)	Lensed cross-section, but is rather hard, brittle, thick; fragment of large jar. Total thickness: 7mm. Kok Moh white ware.
30	DNM	2.5YR, 5/4	Unusually shaped part of cylindrical object with burnished exterior, ribbed interior resulting from turning during production. "Javanese ritual ware."
31	DNM	2.5YR, 5/4	Part of same object?
32	DNM	2.5YR, 5/4	Similar but not identical object.
33	DNM	10YR, 8/2	Thick, unburnished material similar to 24.
34	TRO	2.5YR, 6/6	Base of small jar, fine (1–3 mm thick).
35	TRO	2.5YR, 6/6	
36	TRO	2.5YR, 6/6	Base of fine jar.
37	TRO	5YR, 7/6 (interior) 7.5 YR, 7/4 (exterior)	Base of fine jar.

Sample	*Site*[a]	*Color*	*Description*
38	TRO	5YR, 6/4	Fine, 2 mm thick.
39	TRO	2.5YR, 6/6	Base of fine jar.
40	TRO	2.5YR, 4/4	Flanged kendi rim.

[a]Site abbreviations: FTC: Fort Canning, Singapore (1L, 4L, etc., refer to stratigraphic context of sherds found during excavation; see Miksic 1985*b* for excavation report).
STP: Satingphra, south Thailand.
GTK: Gatak, central Java.
DNH: Dieng Hill, central Java.
TRO: Trowulan, east Java.
KKM: Kok Moh, south Thailand.
DNM: Dieng "monastery," central Java.

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